

The Greenhouse Effect Investigating Global Warming

Greenhouses allow gardeners to grow plants in cooler weather. Radiation from the Sun passes through the glass and is absorbed by objects inside, causing them to increase in temperature and radiate a much longer wavelength of energy back into the greenhouse. This lower-energy thermal radiation is unable to pass back through the glass and is trapped inside the greenhouse. As a result, the temperature of the air inside the greenhouse is increased. With controlled mixing between the inside and outside air, this allows heat in the greenhouse to be regulated.

Earth is surrounded by a layer of gases, some of which help retain heat by acting like the glass in a greenhouse. **Greenhouse gases** such as carbon dioxide (CO₂) do not allow thermal radiation from Earth's surface to escape into space. The effect of each greenhouse gas depends on many factors, such as the quantity of the gas, how long it remains in the atmosphere, and how strongly the gas absorbs radiant energy. A **Global Warming Potential (GWP)** has been calculated to measure the impact of each gas. The greater the GWP, the more the gas contributes to warming Earth.

Human production of greenhouse gases in excess of natural levels is the main cause of global warming. Climate change caused by global warming can have disastrous effects on some organisms. For example, as the sea ice declines populations of algae that live in ice pockets decrease. Zooplankton eat this algae and in turn are eaten by fish, which are an important food source for many animals such as seals. As the population of seals declines, so does the population of polar bears that eat both the fish and the seals.

Terrestrial organisms, such as the American pika, are also impacted by climate change. These rabbit-like animals live in cold areas near mountaintops, and as the climate warms their populations have been decreasing below elevations of 7,000 feet.

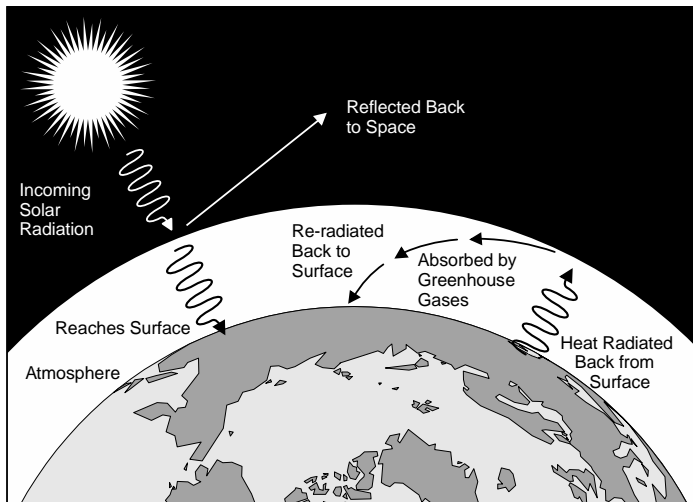


Figure 1. Greenhouse gas cycle.

Pre-Lab Exercises

1. Explain why greenhouse walls can be constructed of glass or clear plastic but not wood or metal.
2. According to the text, what relationship exists between the wavelength of light and the energy associated with it?
3. Consider two greenhouse gases, fluoromethane (CH_3F) and trifluoroethane ($\text{C}_2\text{H}_3\text{F}_3$). Both gases have the same lifespan yet trifluoroethane has a GWP that is approximately double that of fluoromethane. Cite a factor from the introduction that may explain this observation.
4. Refer to Figure 1. Using complete sentences, list the sequence of events that result in global warming.
5. Construct a food web from the information in the text and label the primary producer.